

Journal of the Association for Computing Machinery

VOLUME 33 • 1986

Editor-in-Chief

Michael J. Fischer

Department of Computer Science/Yale University/P.O. Box 2158 Yale Station/
New Haven, CT 06520

Area Editors

Peter J. Downey

Department of Computer Science/The University of Arizona/Tucson, AZ 85721
(Programming Languages and Methodology)

Stanley C. Eisenstat

Department of Computer Science/Yale University/P.O. Box 2158 Yale Station/
New Haven, CT 06520
(Numerical Computation)

Zvi Galil

Computer Science Department/Columbia University/New York, NY 10027
(Complexity of Algorithms)

David S. Johnson

AT&T Bell Laboratories, Inc./600 Mountain Avenue/Murray Hill, NJ 07974
(Combinatorics and Graph Theory)

Stephen S. Lavenberg

IBM T. J. Watson Research Center/P.O. Box 218/Yorktown Heights, NY 10598
(Computer System Modeling and Analysis)

Jan Karel Lenstra

Department of Operations Research and System Theory, Centre for Mathematics
and Computer Science/P. O. Box 4079/1009 AB Amsterdam/The Netherlands
(Operations Research)

Drew McDermott

Department of Computer Science/Yale University/P.O. Box 2158 Yale Station/
New Haven, CT 06520
(Artificial Intelligence)

Jayadev Misra

Department of Computer Science/University of Texas at Austin/Austin, TX 78712
(Distributed Computing)

Daniel J. Rosenkrantz

Department of Computer Science/The State University of New York at Albany/
Albany, NY 12222
(Formal Languages and Models of Computation)

Robert Sedgewick

Department of Computer Science/Princeton University/Princeton, NJ 08544
(Data Structures and Analysis of Algorithms)

Lawrence Snyder

Department of Computer Science/FR-35/University of Washington/Seattle, WA
98195
(Computer Organization and Parallel Processing)

Mihalis Yannakakis

AT&T Bell Laboratories, Inc./600 Mountain Avenue/Murray Hill, NJ 07974
(Database Theory)

Headquarters Quarterlies Staff

Mark Mandelbaum

Director of Publications

Janet G. Benton

Associate Director of Publications

Marilyn Salmansohn

Managing Editor, ACM Quarterlies

Roma Simon

Associate Editor

PUBLISHED BY THE ASSOCIATION FOR COMPUTING MACHINERY
Copyright © 1986, Association for Computing Machinery, Inc.
11 West 42 Street, New York, NY 10036

SUBJECT INDEX

	629	Information for Authors
ARTIFICIAL INTELLIGENCE	633	Dennis de Champeaux—Subproblem Finder and Instance Checker, Two Cooperating Modules for Theorem Provers
	253	Vincent J. Digricoli and Malcolm C. Harrison—Equality-Based Binary Resolution
	658	W. Eric L. Grimson—The Combinatorics of Local Constraints and Model-Based Recognition and Localization from Sparse Data
	1	Zohar Manna and Richard Waldinger—Special Relations in Automated Deduction
CIRCUIT DESIGN	60	K. Mehlhorn and F. P. Preparata—Routing through a Rectangle
COMPUTATIONAL GEOMETRY	290	Takao Asano, Tetsuo Asano, and Hiroshi Imai—Partitioning a Polygonal Region into Trapezoids
COMPUTER SYSTEMS	86	Benny Chor, Charles E. Leiserson, Ronald L. Rivest, and James B. Shearer—An Application of Number Theory to the Organization of Raster-Graphics Memory
	313	Leslie Lamport—The Mutual Exclusion Problem: Part I—A Theory of Inter-process Communication
	327	Leslie Lamport—The Mutual Exclusion Problem: Part II—Statement and Solutions
	687	Vijaya Ramachandran—On Driving Many Long Wires in a VLSI Layout
DATABASE THEORY	409	Serge Abiteboul and Seymour Ginsburg—Tuple Sequences and Lexicographic Indexes
	423	Catriel Beeri and Michael Kifer—Elimination of Intersection Anomalies from Database Schemes
	451	Francis Chin—Security Problems on Inference Controls for SUM, MAX, and MIN Queries
	465	Seymour Ginsburg and Richard Hull—Sort Sets in the Relational Model
	105	Marc H. Graham, Alberto O. Mendelzon, and Moshe Y. Vardi—Notions of Dependency Satisfaction
	349	Raymond Reiter—A Sound and Sometimes Complete Query Evaluation Algorithm for Relational Databases with Null Values
DATA STRUCTURES AND ALGORITHMS	489	Luc Devroye—A Note on the Height of Binary Search Trees
	371	Philippe Fiajole and Claude Puech—Partial Match Retrieval of Multi-dimensional Data
DISTRIBUTED COMPUTING	499	Danny Dolev, Nancy A. Lynch, Shlomit S. Pinter, Eugene W. Stark, and William E. Weihl—Reaching Approximate Agreement in the Presence of Faults
FORMAL LANGUAGES	702	R. Chaudhuri and A. N. V. Rao—Approximating Grammar Probabilities: Solution of a Conjecture
NUMERICAL COMPUTATION	517	Thomas F. Coleman, Anders Edenbrandt, and John R. Gilbert—Predicting Fill for Sparse Orthogonal Factorization
	706	Bruce Jay Collings and G. Barry Hembree—Initializing Generalized Feedback Shift Register Pseudorandom Number Generators
	712	M. Cosnard and Y. Robert—Complexity of Parallel QR Factorization
	130	Boris Lubachevsky and Debasis Mitra—A Chaotic Asynchronous Algorithm for Computing the Fixed Point of a Nonnegative Matrix of Unit Spectral Radius
OPERATIONS RESEARCH	533	Dorit S. Hochbaum and David B. Shmoys—A Unified Approach to Approximation Algorithms for Bottleneck Problems
	551	Samar Singh—Improved Methods for Storing and Updating information in the Out-of-Kilter Algorithm
PROGRAMMING LANGUAGES AND METHODOLOGY	151	E. Allen Emerson and Joseph Y. Halpern—"Sometimes" and "Not Never" Revisited: On Branching versus Linear Time Temporal Logic
PROGRAMMING LANGUAGES AND SYSTEMS	724	K. R. Apt and G. D. Plotkin—Countable Nondeterminism and Random Assignment

**SYSTEM MODELING
AND ANALYSIS**

- 768 A. E. Conway and N. D. Georganas—RECAL—A New Efficient Algorithm for the Exact Analysis of Multiple-Chain Queuing Networks
- 179 Derek L. Eager and Kenneth C. Sevcik—Bound Hierarchies for Multiple-Class Queuing Networks
- 568 Debasis Mitra and J. McKenna—Asymptotic Expansions for Closed Markovian Networks with State-Dependent Service Rates
- 593 John N. Tsitsiklis, Christos H. Papadimitriou, and Pierre Humblet—The Performance for a Precedence-Based Queuing Discipline
- 207 Appie van de Liefvoort and Lester Lipsky—A Matrix-Algebraic Solution to Two K_m Servers in a Loop

**THEORY OF
COMPUTATION**

- 603 Jose L. Balcázar, Ronald V. Book, and Uwe Schöning—The Polynomial-Time Hierarchy and Sparse Oracles
- 792 Oded Goldreich, Shafi Goldwasser, and Silvio Micali—How to Construct Random Functions
- 224 David Harel—Effective Transformations on Infinite Trees, with Applications to High Undecidability, Dominoes, and Fairness
- 808 R. Kannan and R. J. Lipton—Polynomial-Time Algorithm for the Orbit Problem
- 618 Timothy J. Long and Alan L. Selman—Relativizing Complexity Classes with Sparse Oracles
- 822 John H. Rowland and John R. Cowles—Small Sample Algorithms for the Identification of Polynomials

AUTHOR INDEX

- | | | |
|-----------------------|-----|---|
| ABITEBOUL, SERGE | 409 | Tuple Sequences and Lexicographic Indexes |
| APT, K. R. | 724 | Countable Nondeterminism and Random Assignment |
| ASANO, TAKAO | 290 | Partitioning a Polygonal Region into Trapezoids |
| ASANO, TETSUO | 290 | See Asano, Takao |
| BALCÁZAR, JOSE L. | 603 | The Polynomial-Time Hierarchy and Sparse Oracles |
| BEERI, CATRIEL | 423 | Elimination of Intersection Anomalies from Database Schemes |
| BOOK, RONALD V. | 603 | See Balcázar, Jose L. |
| CHAUDHURI, R. | 702 | Approximating Grammar Probabilities: Solution of a Conjecture |
| CHIN, FRANCIS | 451 | Security Problems on Inference Controls for SUM, MAX, and MIN Queries |
| CHOR, BENNY | 86 | An Application of Number Theory to the Organization of Raster-Graphics Memory |
| COLEMAN, THOMAS F. | 517 | Predicting Fill for Sparse Orthogonal Factorization |
| COLLINGS, BRUCE JAY | 706 | Initializing Generalized Feedback Shift Register Pseudorandom Number Generators |
| CONWAY, A. E. | 768 | RECAL—A New Efficient Algorithm for the Exact Analysis of Multiple-Chain Queuing Networks |
| COSNARD, M. | 712 | Complexity of Parallel QR Factorization |
| COWLES, JOHN R. | 822 | See Rowland, John H. |
| DE CHAMPEAUX, DENNIS | 633 | Subproblem Finder and Instance Checker, Two Cooperating Modules for Theorem Provers |
| DEVROYE, LUC | 489 | A Note on the Height of Binary Search Trees |
| DIGRICOLI, VINCENT J. | 253 | Equality-Based Binary Resolution |
| DOLEV, DANNY | 499 | Reaching Approximate Agreement in the Presence of Faults |
| EAGER, DEREK L. | 179 | Bound Hierarchies for Multiple-Class Queuing Networks |
| EDENBRANDT, ANDERS | 517 | See Coleman, Thomas F. |
| EMERSON, E. ALLEN | 151 | "Sometimes" and "Not Never" Revisited: On Branching versus Linear Time Temporal Logic |
| FLAJOLET, PHILIPPE | 371 | Partial Match Retrieval of Multi-Dimensional Data |
| GEORGANAS, N. D. | 768 | See Conway, A. E. |
| GILBERT, JOHN R. | 517 | See Coleman, Thomas F. |
| GINSBURG, SEYMOUR | 409 | See Abiteboul, Serge |
| | 465 | Sort Sets in the Relational Model |
| GOLDREICH, ODED | 792 | How to Construct Random Functions |
| GOLDWASSER, SHAFI | 792 | See Goldreich, Oded |
| GRAHAM, MARC H. | 105 | Notions of Dependency Satisfaction |
| GRIMSON, W. ERIC. L. | 658 | The Combinatorics of Local Constraints in Model-Based Recognition and Localization from Sparse Data |
| HALPERN, JOSEPH Y. | 151 | See Emerson, E. Allen |
| HAREL, DAVID | 224 | Effective Transformations on Infinite Trees, with Applications to High Undecidability, Dominoes, and Fairness |
| HARRISON, MALCOLM C. | 253 | See Digricoli, Vincent J. |
| HEMBREE, G. BARRY | 706 | See Collings, Bruce Jay |
| HOCHBAUM, DORIT S. | 533 | A Unified Approach to Approximation Algorithms for Bottleneck Problems |
| HULL, RICHARD | 465 | See Ginsburg, Seymour |
| HUMBLET, PIERRE | 593 | See Tsitsiklis, John N. |
| IMAI, HIROSHI | 290 | See Anano, Takao |
| KANNAN, R. | 808 | Polynomial-Time Algorithm for the Orbit Problem |
| KIFER, MICHAEL | 423 | See Beeri, Catriel |
| LAMPORT, LESLIE | 313 | The Mutual Exclusion Problem: Part I—A Theory of Interprocess Communication |
| | 327 | The Mutual Exclusion Problem: Part II—Statement and Solutions |
| LEISERSON, CHARLES E. | 86 | See Chor, Benny |
| LIPSKY, LESTER | 207 | See van de Liefvoort, Appie |

LIPTON, R. J.	808	See Kannan, R.
LONG, TIMOTHY J.	518	Relativizing Complexity Classes with Sparse Oracles
LUBACHEVSKY, BORIS	130	A Chaotic Asynchronous Algorithm for Computing the Fixed Point of a Nonnegative Matrix of Unit Spectral Radius
LYNCH, NANCY A.	499	See Dolev, Danny
MANNA, ZOHAR	1	Special Relations in Automated Deduction
MCKENNA, J.	568	See Mitra, Debasis
MEHLHORN, K.	60	Routing through a Rectangle
MENDELZON, ALBERTO O.	105	See Graham, Marc H.
MICALI, SILVIO	792	See Goldreich, Oded
MITRA, DEBASIS	130	See Lubachevsky, Boris
	568	Asymptotic Expansions for Closed Markovian Networks with State-Dependent Service Rates
PAPADIMITRIOU, CHRISTOS H.	593	See Tsitsiklis, John N.
PINTER, SHLOMIT S.	499	See Dolev, Danny
PLOTKIN, G. D.	724	See Apt, K. R.
PREPARATA, F. P.	60	See Mehlhorn, K.
PUECH, CLAUDE	371	See Flajolet, Philippe
RAMACHANDRAN, VIJAYA	687	On Driving Many Long Wires in a VLSI Layout
RAO, A. N. V.	702	See Chaudhuri, R.
REITER, RAYMOND	349	A Sound and Sometimes Complete Query Evaluation Algorithm for Relational Databases with Null Values
RIVEST, RONALD L.	86	See Chor, Benny
ROBERT, Y.	712	See Cosnard, M.
ROWLAND, JOHN H.	822	Small Sample Algorithms for the Identification of Polynomials
SCHÖNING, UWE	603	See Balcázar, Jose L.
SELMAN, ALAN L.	618	See Long, Timothy J.
SEVCIK, KENNETH C.	179	See Eager, Derek L.
SHEARER, JAMES B.	86	See Chor, Benny
SHIMOYS, DAVID B.	533	See Hochbaum, Dorit S.
SINGH, SAMAR	551	Improved Methods for Storing and Updating Information in the Out-of-Kilter Algorithm
STARK, EUGENE W.	499	See Dolev, Danny
TSITSIKLIS, JOHN N.	593	The Performance of a Precedence-Based Queuing Discipline
VAN DE LIEFVOORT, APPIE	207	A Matrix-Algebraic Solution to Two K_m Servers in a Loop
VARDI, MOSHE Y.	105	See Graham, Marc H.
WALDINGER, RICHARD	1	See Manna, Zohar
WEIHL, WILLIAM E.	499	See Dolev, Danny